

## STRAP TENSION INDICATION

The present invention relates to a device for indicating strap tension.

5 In an automotive child restraint system, typically a child safety seat attached to the adult seat of a car, there is a requirement to tension the straps holding the child into the child seat and/or the strap(s) tethering the child seat in the vehicle. For the former straps, normally this is done by drawing out a central strap, which is attached to and tensions the individual straps, particularly the shoulder straps. In the latter  
10 case, tensioning is likely to be by tightening of the strap with a conventional strap adjuster.

Conventional tensioning arrangements have no means by which the user can gauge the tension in the straps, aside from feeling them.

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In this specification, the term "tension indicator" is used to mean a device to indicate absence of slack.

The object of the present invention is to provide an indicator for indicating  
20 tension in a restraint strap.

According to the invention, there is provided a tension indicator in combination with a strap whose tension is to be indicated, the combination comprising:

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- the strap and
- a tension indicator, the tension indicator comprising:
  - a resilient member attached at its ends to two points along the length of the strap, the points of attachment being further apart in the longitudinal direction of the strap than the free, non-tensioned, length of the resilient member between its ends, whereby when the strap is slack the resilient  
30 member draws a bight in it between the attachment points and

- means for visually indicating elongation of the resilient member when the strap and the resilient member are stretched in tension, whereby absence of slack in the strap can be noted.

5           It should be understood that by the “ends” of the resilient member is intended not necessarily its terminal ends, but its effective ends in that they represent the points of attachment and transfer of tensile force to the resilient member in use. For instance, in one embodiment, where the resilient member is a length of elastomeric belt stitched to the strap, vestigial pieces between the stitching and the terminal ends  
10       perform no part in the stretching of the resilient member to indicate tension in the strap.

          The sleeve can be attached to the strap remote from the end of the resilient material. For instance, the resilient material may be attached to the strap via the  
15       sleeve. However, the sleeve and the resilient member are preferably stitched together by the same stitching to the strap.

          Thus in one preferred embodiment:

- the resilient member is an inner member and
- 20       • the indicating means is:
  - an outer member attached at its ends to the ends of the resilient member and encasing the resilient inner member, the outer member being provided with
  - at least one opening arranged to open on stretching of the outer member to  
25       expose the inner resilient member to view

          the arrangement being such that with both members having their ends attached to each other and the strap, both the outer and the inner members stretch in use.

          In particular:

- 30       • the resilient member is a length of resilient material attached at two points along the length of the strap, the points of attachment being further apart in the longitudinal direction of the strap than the free, non-tensioned, length of the resilient material; and

- the visual indicating means is a sleeve attached to the strap with the resilient material being accommodated within the sleeve, the sleeve being of a length to cover the resilient material when it is not tensioned;

the arrangement being such that on tensioning of the strap, the resilient material is drawn from the sleeve and being exposed to view indicates that the strap is tensioned.

The sleeve can be provided at either end of the resilient material, or indeed at both ends. If it is attached at one end, it will expose the resilient material at the other end. If it is attached at both ends, the exposure is in the middle.

In another embodiment:

- the resilient member is an outer member having a central void and
- the indicating means includes:
  - at least one opening in the resilient outer member and arranged to open on stretching of the outer member and
  - an inner member provided in the void inside the resilient outer member, the inner member being visible through the or each opening when the outer member is in its stretched state.

In one alternative, the inner member is an extensible member having its ends attached to the strap, preferably at the ends of the outer member. Alternatively, the inner member is an inextensible member attached to the strap, preferably at one of its ends to one of the ends of the outer member. Again, the inner member can be captivated within the outer member by the outer member alone.

Preferably, the resilient member is a coil spring, attached to the strap by end eyes, and the indicating member is a peg or rod within the spring. The coil spring can be of the type which is coil bound when under no tension, thereby obscuring the indicating member until tensioned sufficiently to open the coils of the spring.

To help understanding of the invention, two specific embodiments thereof will now be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a tension indicator and a strap in accordance with the invention in a relaxed state;

Figure 2 is a similar view of the indicator in a tensioned state;

Figure 3 is a view similar to Figure 1 of a second tension indicator and strap  
5 of the invention; and

Figure 4 is a view similar to Figure 2 of the second tension indicator.

Referring first to Figures 1 & 2 of the drawings, a webbing strap 1 of the type used in a safety harness, e.g. for strapping a child into a safety seat or for tethering a  
10 safety seat in a vehicle, has a piece of elastomeric belt 2 stitched 3 to it at two points along its length. The position of the two stitchings along the length of the strap is such that in the relaxed state of the strap, with not tension in either the strap or the belt, the later draws a bight or belly 4 into the strap.

15 Two lengths 5,6 of sleeving are stitched into the same points 3. The elastomeric belt is threaded within the lengths of sleeving. These are of equal length and jointly extend for the full length of the elastomeric belt in its relaxed state. The sleeving being of a type which does not readily crumple, such as filled and calendered non-woven material, it completely encloses the elastomeric belt when relaxed as  
20 shown in Figure 1.

When the elastomeric belt is tensioned, it opens at the joint between the two lengths 5,6 and stretches to a length greater than the sleeving. Thus it becomes exposed to view between the lengths of sleeving, as shown in Figure 2. The extent of  
25 stretching of the belt is limited by the distance along the strap between the stitching. Once the strap is straightened, the belt will stretch no more.

The actual tension in the strap, when the belt is fully stretched will be that in belt or more if the strap is carrying tension in parallel to the belt.

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The length of the belt and the separation in the strap of the stitching will be chosen to ensure that the belt is fully stretched when the tension has reached the desired level.

This desired level can be indicated simply by the belt being exposed and the belly being pulled out of the strap.

Alternatively, belt can be coloured, whereby the exposed portion is red R for instance when insufficient tension is present, but the length of red colour is limited whereby when the belt is fully tensioned green portions G are exposed on either side of the red portion.

In another alternative, the elastomeric belt can be replaced by a piece of shock cord or indeed a coil spring as the length of resilient material or resilient member.

Referring now to Figures 3 and 4, the tension indicator there shown comprises a coil spring 11 of the type that is coil bound, as shown in Figure 3, when carrying no tension. It has eyes 12 at its ends, by which it is stitched 14 to a strap 15. Loose inside the spring, and invisible in Figure 3 when the strap is slack, a peg 16 is enclosed. When the strap is tensioned, the peg becomes visible indicating tension in the strap, in the same way as exposure of the belt indicates tensioning of the strap in Figure 2.